ARIZONA GAME AND FISH DEPARTMENT
HABITAT PARTNERSHIP COMMITTEE
HABITAT ENHANCEMENT AND WILDLIFE MANAGEMENT PROPOSAL

Game Branch / HPC Project Number:	12-510

PROJECT INFORMATION

Project Title: Estimating the 2009 black bear population in the Chiricahua Mountains of southeastern Arizona

Region and Game Management Unit: Region 5, GMU 29 and 30A

Local Habitat Partnership Committee (LHPC):
- Sierra Vista/Douglas

Was the project presented to the LHPC?
YES[] **NO**[X]

Has this project been submitted in previous years? **YES**[] **NO**[X]
If Yes, was it funded? **YES**[] **NO**[] → **Funded HPC Project #(s)**:

Project Type: Population Survey—Genetic analysis

Brief Project Summary: This project will analyze genetic samples (i.e., hair) collected from black bears in 2009 in the Chiricahua Mountains of southeast Arizona (Region 5, GMU 29 and 30A). Molecular data can then be used to estimate the number of unique individuals identified in the local population and estimate bear density and sex ratios.

Big Game Wildlife Species to Benefit: Black Bear. This project contributes to better black bear management practices by providing a density estimate in the Chiricahuas, and, together with genetic data collected previously, allows for greater understanding of how bears move across a fragmented landscape. Data from this project will provide a better population estimation that will support hunting management of bears and may expand hunting options. It will help us understand the genetic relatedness of individuals among ranges and may also contribute greatly to future efforts by the Department to provide an updated density estimate across multiple habitat types for black bears statewide.

Implementation Schedule (Month/Day/Year):

Project Start Date: April 2013 (genetic analysis will continue when appropriate funding is acquired. Hair samples were collected in 2009).

Project End Date: December 2013

Environmental Compliance:
NEPA Completed: Yes[] No[] N/A[X]
Projected Completion Date: _____

State Historic Preservation Office - Archaeological Clearance:
Yes[] No[] N/A[X]
Projected Completion Date: _____

Arizona Game and Fish Department EA Checklist: N/A[]
To be Completed by: Kirby Bristow
Projected Completion Date: EAC Complete- # M10-05204046

PROJECT FUNDING

Special Big Game License Tag Funds Requested:	**$13,125.00**
Cost Share or Matching Funds:	**$28,696.80** (field expenses funded by Federal Aid for sample collection in 2009)
Total Project Costs:	**$ 41,821.80**

PARTICIPANT INFORMATION		
Applicant (please print): Kirby Bristow (Wildlife biologist) Larisa Harding (Program Mngr) Michelle Crabb (Wildlife Technician)	**Address**: Arizona Game and Fish 5000 W. Carefree Hwy Phoenix, AZ	**E-mail**: kbristow@azgfd.gov, lharding@azgfd.gov, mcrabb@azgfd.gov
Telephone: (623)236-7221		**Date**: 8/31/2012
AGFD Contact and Phone No. (If applicant is not AGFD personnel):		
Project has been coordinated with: *For collection of samples:* AZGFD- Region 5 personnel, USFS- Coronado National Forest, and National Park Service- Chiricahua National Monument (Park-assigned Permit # CHIR-2010-SCI-0004).		

NEED STATEMENT – PROBLEM ANALYSIS:

Population density estimates for black bears in Arizona are currently based on demographic data collected in the 1980s from a few representative habitats in the state. Updated information on population structure of these large carnivores is important to guide management plans and habitat alterations, and to support harvest management, especially of isolated bear populations in southeastern Arizona, where "sky islands" containing suitable bear habitat are separated by expansive arid desert valleys and growing anthropogenic influences (e.g., roads, infrastructure, agriculture, increasing human populations). Indeed, evaluating bear conservation strategies was identified as one of the AZGFD Director's Goals and Objectives in 2009 and, more recently, Department personnel have reconfirmed the need to update bear population estimates statewide using genetic tools, as suggested in the "Mountain Lion and Bear Conservation Strategies Report" (AZGFD 2009) approved by the Commission in 2009. To date, little information is available for current bear densities across Arizona, though densities are expected to be lower in isolated ranges of southeastern Arizona than in more connected habitats of central Arizona. Non-invasive genetic sampling and molecular analysis of black bears in the sky island Huachuca-Patagonia mountain complex, and within the White Mountains in central Arizona, began in 2007 and produced density estimates of 0.06 bear/km^2 and 0.21 bear/km^2, respectively (Atwood et al. 2011). Genetic analysis of the Huachuca-Patagonia bear population generated estimates on bear density that were substantially higher than prior estimates built on trapping or tracking observations. It also revealed that the southern populations were less genetically diverse and suggested the potential for these bear populations to be extirpated more quickly by the effects of spatial isolation. Habitat connectivity models from that work also indicated that the Chiricahua Mountains are highly isolated from other suitable bear habitats in the sky islands and lack favorable corridors to encourage movement by bears to maintain viable gene flow between populations. However, these models also showed that the Chiricahua range contained the largest tract of favorable bear habitat in the region. Subsequently, non-invasive genetic sampling across bear habitats in the Chiricahuas was conducted in the spring of 2009, but lack of funding has precluded genetic analyses of all the samples. Because the Chiricahua range represents a significant block of suitable bear habitat in southern Arizona and black bear population numbers may already be low as a result of natural landscape fragmentation, we request funds to conduct DNA analysis on samples collected in this area. An improved characterization of bear demographics in the Chiricahuas will greatly aid our ability to manage bears in a landscape that is also becoming increasingly vulnerable to

severe habitat fragmentation by human forces. Genetic information from this population may also prove critical to future estimates of population density of bears in multiple habitats statewide and provide information to better understand the genetic diversity or relatedness of populations and the degree of habitat connectivity between bear populations in Arizona. Density estimates from genetic analysis may also demonstrate that bear populations are larger than previously thought, as in Atwood et al. (2011), and may therefore lead to expanded hunting options for sportsmen.

PROJECT OBJECTIVES:

Immediate objective

- Analyze genetic samples for black bears collected in the Chiricahua Mountains in 2009.
- Use molecular data to estimate the population size and structure of black bears in the Chiricahua Mountains in Region 5 (GMU 29 and 30A).

Potential future uses of resulting data

- Incorporate genetic data from the Chiricahua bear population into statewide estimates of bear density by habitat type.
- Analyze connectivity and genetic diversity of the isolated Chiricahua bear population relative to other "sky island" populations. Use this information to address habitat fragmentation and improvement of connecting corridors for bears and other large mammals in Arizona.
- Improve estimates of black bear density from harvested bears and hair snags.
- Recommend feasibility of long-term genetic sampling of bear populations statewide to provide best approximations of bear density throughout Arizona.

PROJECT DESCRIPTION AND STRATEGIES:

Field Endeavors (already completed)

Collection of bear hair samples began in 2007 in the Huachuca and Patagonia mountains, as well as the White Mountains in central Arizona, and continued in 2009 in the Chiricahua Mountains (Fig. 1). As not all habitats across these ranges represented suitable bear habitat, we considered suitable habitat to be areas typically above 3500ft. in elevation and contained within Madrean evergreen woodland, Petran Montane conifer forest, or the Petran subalpine conifer forest vegetation types (Brown and Lowe 1978). We systematically sampled bear habitat using hair snags set in a grid pattern. Our sampling incorporated the average estimated home range size of a female black bear in Arizona. Thus we employed 4×4 km^2 grid plots over the Chiricahua range and placed one hair snag near the center of each grid cell (Fig. 2). Each hair snag corral consisted of a single strand of 4-pronged barbed-wire strung approximately 20 m in circumference and erected 0.5 m above the ground surrounding a scent lure (Woods et al. 1999). Snags were baited initially and checked two weeks later and then rebaited and checked again two weeks later. Preventative measures were taken to minimize DNA contamination of samples in collection and processing, and all hair samples were catalogued and stored for analysis by the Arizona Cooperative Fish and Wildlife Research Unit. In addition, we opportunistically collected tissues from hunter harvest or road-killed bears. Hunters in Arizona are required to physically register all bears that are harvested and AZGFD employees collect muscle tissue from each registered bear. AZGFD employees also routinely collected tissue from nuisance bears captured and from road-killed bears. Information on each individual and locality were recorded and all tissue samples have been frozen pending genetic analysis.

Genetic Analysis

These funds will be used to extract DNA from all hair samples that have a minimum of 5 follicles, with a goal of obtaining 105 complete genotypes for hair samples taken from the Chiricahua range. These samples will be identified to species using mitochondrial DNA sequencing and then all black bear hair samples will

be genotyped at 9 microsatellite loci proven to differentiate distinct genotypes among black bears (Paetkau et al. 1998). Representative microsatellite loci include the following: G10J, G10M, G10X, G10B, G10H, G10L, G1D, G1A, and BM3-P1A08. Sex determination of bear DNA samples will also be conducted with fragments of the amelogenin gene, and established DNA processing protocols (detailed in Woods et al. 1999 and Paetkau 2003) will be followed to minimize genotyping errors. Each bear hair sample will be amplified three independent times for each microsatellite locus to cross-validate sample quality and scoring of genotypes. Limited Federal Aid funding has allowed us to begin molecular work on a portion of the total sample from the Chiricahua range, but to produce the most accurate and comprehensive population estimate and to characterize the bear population in the Chiricahuas relative to other bear populations statewide, we request funds to analyze the 105 samples indicated here.

PROJECT LOCATION:
Sample collections were located across approximately 700km^2 in the Chiricahua Mountains of Region 5 GMU 29 and 30A (Figs. 1 and 2). The Chiricahua Mountains are roughly centered at T18S, R30E, SEC 20/29.

LAND OWNERSHIP AT THE PROJECT SITE(S)*:*
(if the project area is private property, please state specifically and provide the landowner's name)

- US Forest Service, Coronado National Forest, Douglas Ranger District and National Park Service, Chiricahua National Monument

IF PRIVATE PROPERTY, IS THERE A COOPERATIVE BIG GAME STEWARDSHIP or LANDOWNER AGREEMENT BETWEEN THE LANDOWNER AND THE DEPARTMENT?
YES[] NO[] N/A[X]

HABITAT DESCRIPTION:
The Chiricahua Mountains range in elevation from 1,341m (4400ft) to 2,961m (9759ft) at Chiricahua Peak, and vegetation varies along this altitudinal gradient. Vegetation at low elevations is semidesert grassland and Chihuahuan desert scrub, mid-elevations are Madrean evergreen woodland, with higher elevations dominated by Petran montane conifer forest and a very small amount of Petran subalpine conifer forest.

ITEMIZED USE OF FUNDS:
Special Big Game License Tag Funds
- Genetic analysis of 105 samples of black bear hair

Line items:

- Technician salary for 105 samples = $5479.95
- Technician ERE for 105 samples = $2395.05
- Consumable Materials and Supplies for 105 samples = $5250.00
  - Total: $13,125.00

Salary will pay a molecular technician's time to extract DNA from hair, perform PCR amplification and fragment analyses on bear samples. Consumable materials and supplies include kits necessary for DNA extraction and PCR amplification as well as other buffers and reagents. In addition, disposables such as pipette tips, tubes, gloves and pipettes will be purchased.

WOULD IMPLEMENTATION OF THIS PROJECT ASSIST IN PROVIDING, MAINTAINING, OR FACILITATING RECREATIONAL ACCESS?
YES[] NO[] N/A[X]

PROJECT MONITORING PLAN:
Larisa Harding (Program Manager) and Kirby Bristow (Project Coordinator) will supervise the project.

PROJECT MAINTENANCE:
No maintenance will be required.

PROJECT COMPLETION REPORT TO BE FILED BY:
A project completion report will be filed by December 2013 by Kirby Bristow and Larisa Harding.

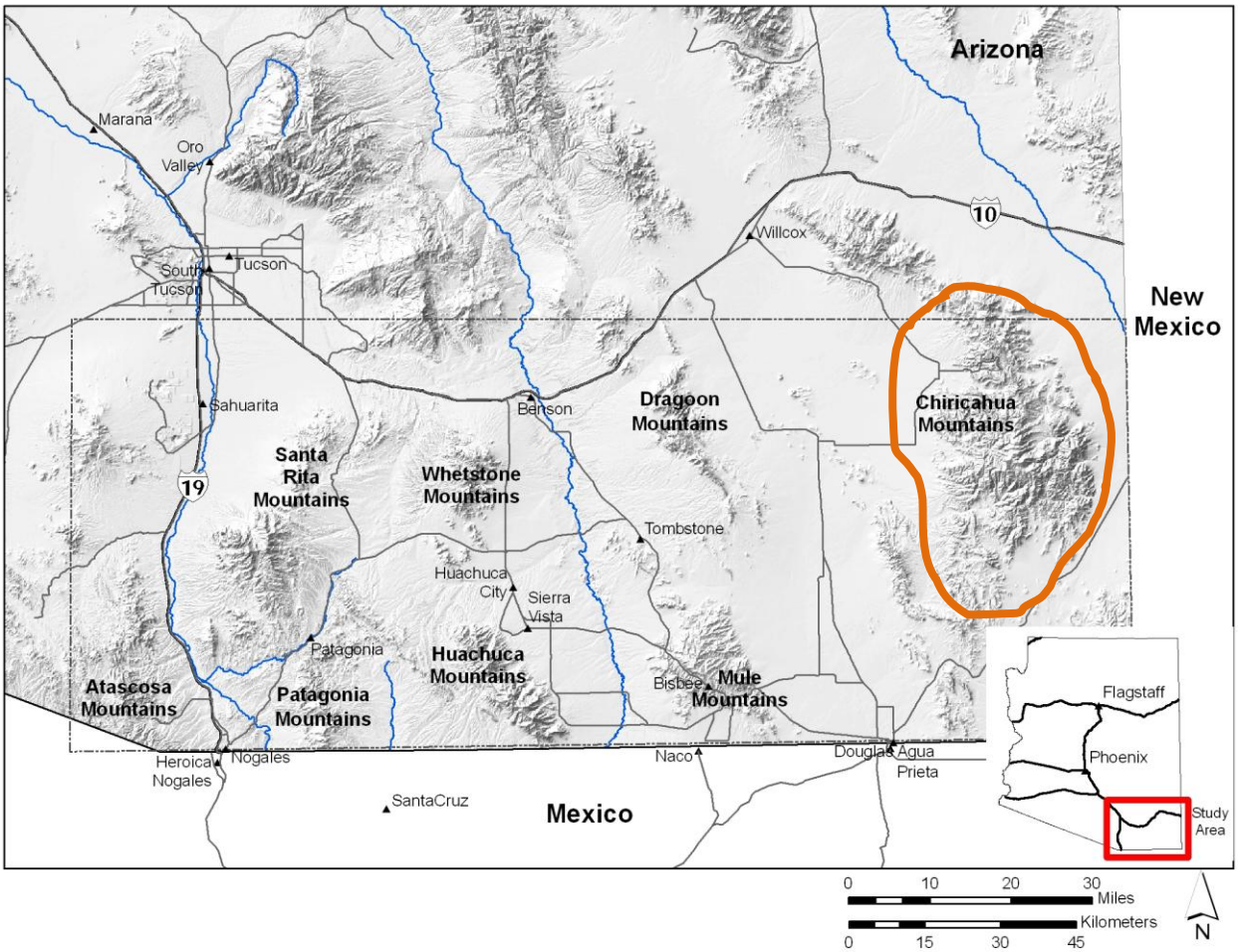

Fig. 1. “Sky Islands” in southern Arizona, with the Chiricahua Mountains outlined in orange. Inset shows location of sky islands in Arizona.

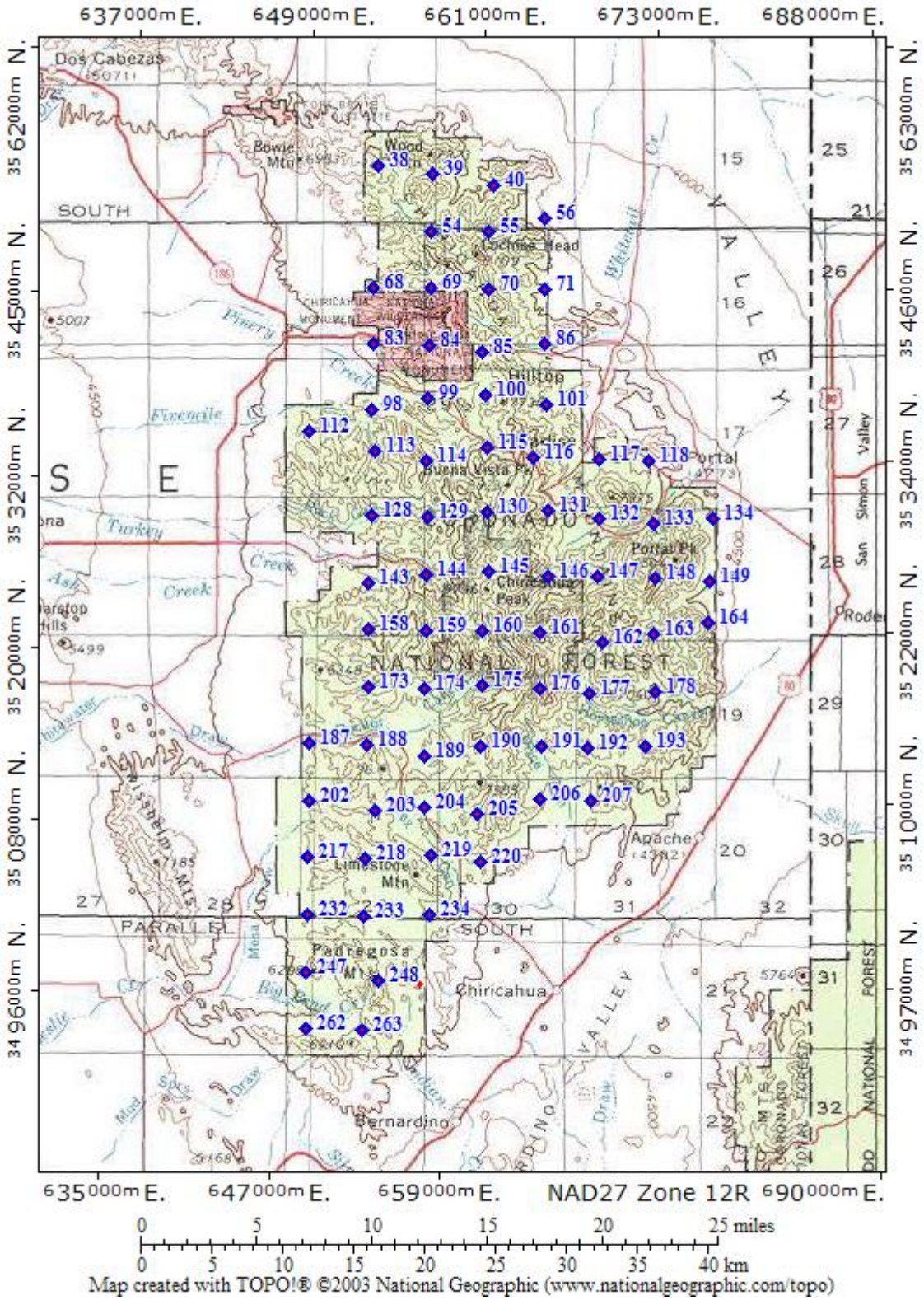

Fig. 2. Detailed view of Chiricahua Mountains showing individual hair snag locations. Numbers represent unique identifiers for each hair snag station.